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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER	
ZERVIGON, RUDY	
ART UNIT	**PAPER NUMBER**
1763	

DATE MAILED: 05/03/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/298,064	Applicant(s) XING ET AL.	
	Examiner Rudy Zervigon	Art Unit 1763	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *16 February 2006*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *20-25* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *20-25* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

2. Claims 20-25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mehrdad M. Moslehi (USPat. 5,082,517) in view of P. J. Matsuo et al[1]. Moslehi teaches the control of the composition of neutral and reactive species, and it's importance to plasma processing, is taught by Mehrdad M. Moslehi (column 1, lines 46-68; column 2, lines 37-42; column 4, lines 9-14; column 12, lines 56-68). Specifically, Mehrdad M. Moslehi describes a process conversion (column 4, lines 55-60) system including:

i. A system (Figure 1) for reacting a plasma with a substrate
ii. a first chamber (18, Figure 1)
iii. a gas source (12, Figure 1) coupled to the first chamber comprising
iv. constituents (12, Figure 1) adapted to react with a substrate (48, Figure 1)
v. an energy source (38) coupled to the first chamber
vi. a second chamber (24) configured to house a substrate for processing
vii. a machine readable storage medium (40) configured to control the introduction of a gas from the gas source into the first chamber (column 12, lines 65 – column 13, line 14; column 13, lines 57-68, 33-43) and to control the introduction of an energy from the energy source (column 5, lines 43-52)

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[1] *J. Vac.Sci.Technol.* A **15**(4), Jul/Aug 1997

viii. executable program instructions for the machine readable storage medium comprising a computer readable medium having a computer-readable program embodied therein for directing operation of the system (column 5, lines 43-52; column 14, lines 3-20), the computer readable program comprising:

ix. instructions for controlling the gas source (column 14, 3-20) and the energy source (column 14, lines 3-20) to convert a portion of a gas supplied by the gas source into a plasma comprising plasma nitrogen ions and radicals (column 4, lines 9-14; column 10, lines 55-60, definition of plasma) and to deliver the plasma to the second chamber substantially (column 4, lines 9-14; column 11, lines 54-63; column 1, lines 46-52) free of nitrogen ions to react with a substrate in the second chamber in a process conversion step

x. The machine readable storage medium (40) of claim 20, wherein the method performed by the digital processing system (40) further comprises: reacting the plasma radicals (column 4, lines 9-14; column 10, lines 55-60, definition of plasma) with a film on a substrate (48; Figure 1), as claimed by claim 21

xi. The machine readable storage medium (40) of claim 21, wherein reacting the plasma radicals (column 4, lines 9-14; column 10, lines 55-60, definition of plasma) with a film on a substrate (48) comprises converting a portion of the film into a nitrogen-containing material (12), as claimed by claim 22

xii. A machine readable storage medium (40; Figure 1) containing executable program instructions which when executed cause a digital processing system (40; Figure 1) to perform a method comprising: generating a plasma from nitrogen comprising nitrogen radicals (column 4, lines 9-14; column 10, lines 55-60, definition of plasma) and nitrogen ions

(column 4, lines 9-14; column 10, lines 55-60, definition of plasma) in a first chamber (18, Figure 1); and transferring the plasma to a substrate (48; Figure 1) site within a second chamber (24) so that at the substrate (48; Figure 1) site the plasma is substantially free of the nitrogen ions (column 4, lines 9-14; column 10, lines 55-60, definition of plasma), as claimed by claim 23

xiii. The machine readable storage medium (40; Figure 1) of claim 23. wherein the method performed by the digital processing system (40; Figure 1) further comprises; reacting the plasma radicals (column 4, lines 9-14; column 10, lines 55-60, definition of plasma) with a film on a substrate (48; Figure 1), as claimed by claim 24

xiv. The machine readable storage medium (40; Figure 1) of claim 24, wherein reacting the plasma radicals (column 4, lines 9-14; column 10, lines 55-60, definition of plasma) with a film on a substrate (48; Figure 1) comprises converting a portion of the film into a nitrogen-containing material, as claimed by claim 25

Moslehi does not teach transferring the plasma radicals via a distance equivalent to the lifetime of the nitrogen ions into a second chamber substantially free of ions.

Matsuo et al teaches a plasma semiconductor processing apparatus that generates a microwave plasma remotely relative to the substrate location (Section I, Introduction; Figure 1). Additionally, the variable length of the plasma delivery tube is assessed under numerous conditions such as etch rates (Section III.A.2, p.1803), reaction layer thickness (Section III.C.4, p.1809), atomic (neutral) and reactive (radical) species concentration (Section IV.B, p.1812).

Specifically, and to further illustrate the teachings of P. J. Matsuo et al, the researchers describe:

i. a first reaction chamber (Adownstream tubing/lining, "Applicator" box portion of Adownstream tubing/lining, Figure 1)

ii. a gas source (fluoromethane, oxygen, nitrogen, Figure 1) coupled to the first reaction chamber to supply a nitrogen gas to the first reaction chamber

iii. an excitation energy source (Aapplicator, 2.45GHz, Figure 1) coupled to the first reaction chamber to generate a nitrogen plasma comprising nitrogen ions and radicals from the nitrogen gas

iv. a second reaction chamber (Aprocessing chamber, Fig.1) adapted to house a substrate at a site in the second reaction chamber

v. wherein the first reaction chamber is coupled to the second reaction chamber and separated from the substrate site by a distance equivalent to the lifetime of the nitrogen ions (Figure 4) at a plasma generation rate such that the radicals react with the substrate in a process conversion step (film deposition, Refer to Figure 10(d) and section C.1 - At point (d) N_2 is injected once more and the reaction layer thickness increases again.)

vi. the excitation energy source supplies energy having a microwave frequency to generate a plasma from the nitrogen gas (abstract, first sentence)

vii. The dimensions of the first reaction chamber (A...as the distance from the plasma to the etching region is increased...) are configured such that substantially all of the nitrogen ions generated by the nitrogen plasma are changed from an ionic state to a charge neutral state within the first reaction chamber (Section IV.B, p.1812; Figure 25)

viii. An apparatus (Figure 1) for exposing a substrate to plasma, comprising a first reaction chamber (Adownstream tubing/lining, Figure 1)

ix. means for supplying a nitrogen gas (fluoromethane, oxygen, nitrogen, Figure 1) to the first reaction chamber

x. means for generating a plasma from the nitrogen gas (applicator, 2.45GHz, Figure 1)

xi. the plasma comprising nitrogen ions and radicals (definition of plasma)

xii. a second reaction chamber (processing chamber, Fig.1) having means for housing a substrate

xiii. means for providing the plasma to the second reaction chamber substantially free of nitrogen ions such that the radicals react with a substrate in a process conversion step (Section IV.B, p.1812)

Item v above appears to be implicitly taught according to Figure 4. As shown in Figure 4, there are non-zero etch rates up to 125cm of first reaction chamber lengths. As such, lifetime of the nitrogen ions, up to and including these distances, are sufficiently long enough so that the radicals react with the substrate in a process conversion step. However, although P. J. Matsuo et al teach all the structural limitations as described above, Matsuo's operation of the provided structure (Figure 1), as described in the reference, is not completely clear in anticipation that Matsuo's operation can provide a separation between chambers such that the separation is equivalent to the lifetime of the nitrogen ions at a plasma generation rate such that the radicals react with the substrate.

However, Matsuo states that the separation distance plays a major role in which reactive species survive and reach the processing chamber (Section III.B.2, Page 1803, second sentence) under the variable conditions of flow control ("Mass Flow Controllers"; Figure 1) and microwave power (Section II - Experimental).

Matsuo's processing parameters of tube length, flow control, and microwave power can be optimized to meet the claimed property and function such that transferring of the plasma radicals via a distance equivalent to the lifetime of the nitrogen ions into a second chamber substantially free of ions.

It would have been obvious to one of ordinary skill in the art at the time the invention was made for Moslehi to optimize the operation (variable length, flow rate, microwave power, gas identity, pressure; Section II – Experimental Apparatus and Procedure) of the apparatus, as taught by Matsuo, to provide a separation between chambers such that the separation is equivalent to the lifetime of the nitrogen ions at a plasma generation rate such that the radicals react with the substrate as taught by Matsuo.

Motivation for Moslehi to optimize the operation of the apparatus to provide a separation between chambers such that the separation is equivalent to the lifetime of the nitrogen ions at a plasma generation rate such that the radicals react with the substrate is to form a desired film with desired characteristics as taught by Matsuo (Section IV.B, p.1812). Further, it would be obvious to those of ordinary skill in the art to optimize the operation of the claimed invention (In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980); In re Hoeschele, 406 F.2d 1403, 160 USPQ 809 (CCPA 1969); Merck & Co. Inc. v. Biocraft Laboratories Inc., 874 F.2d 804, 10 USPQ2d 1843 (Fed. Cir.), cert. denied, 493 U.S. 975 (1989); In re Kulling, 897 F.2d 1147, 14 USPQ2d 1056 (Fed. Cir. 1990), MPEP 2144.05).

Response to Arguments

3. Applicant's arguments with respect to claims 21-25 have been considered but are moot in view of the new grounds of rejection.

Conclusion

4. Applicant's amendment necessitated the new grounds of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

1. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Examiner Rudy Zervigon whose telephone number is (571) 272-1442. The examiner can normally be reached on a Monday through Thursday schedule from 8am through 7pm. The official fax phone number for the 1763 art unit is (571) 273-8300. Any Inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Chemical and Materials Engineering art unit receptionist at (571) 272-1700. If the examiner can not be reached please contact the examiner's supervisor, Parviz Hassanzadeh, at (571) 272-1435.

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